BTEC Assignment Brief

Qualification	Pearson BTEC International Level 3 Subsidiary Diploma in Applied Science Pearson BTEC International Level 3 Foundation Diploma in Applied Science Pearson BTEC International Level 3 Diploma in Applied Science Pearson BTEC International Level 3 Extended Diploma in Applied Science Pearson BTEC International Level 3 Extended Diploma in Biomedical Science
Unit number and title	**Unit 21: Applications of Organic Chemistry**
Learning aim(s)	**D:** Investigate spectroscopic and chromatographic techniques to identify organic compounds and determine quantities
Assignment title	**Spectroscopic and chromatographic techniques**
Assessor	
Issue date	
Hand in deadline	

Vocational Scenario or Context	You are a laboratory technician working in an analytical laboratory and in this role you learnt that analytical techniques such as spectroscopy and chromatography are important methods of analysing organic compounds. These analytical techniques are used in research and in manufacturing laboratories to ensure the identification of new compounds and in the quality control of the purity of compounds being produced. Chromatographic techniques such as GC and HPLC are also used as a quantitative measure of the yield of products. You are trained to carry out a range of spectroscopic techniques to identify compounds and determine concentrations. Your laboratory is commissioned by companies to carry out analysis on various organic compounds on a daily basis. Once the commissioned task is complete, the methods and findings are checked for accuracy, before being presented to the customer.

Task	You will need to **analyse** data from chromatograms and spectra to identify structures of unknown compounds. Use GC and HPLC chromatograms to identify and **determine** the amount of organic compounds. **Link** spectra to the structures of at least four known organic compounds. **Explain** how GLC and HPLC instrumentation operates to separate and identify organic compounds. Your final portfolio will comprise of the following 2 sections: Section 1 - Spectral analysis • **Explain** the principles of spectroscopic techniques (of mass spectrometry, infrared 1 13 spectrometry, H NMR and C NMR spectroscopy). Key components and processes must be explained and could be illustrated and annotated. Sourced images are not acceptable. The explanation must include reference to how each spectroscopic technique provides information about an organic molecule and the limitations of use of the technique on its

	own. • You will be provided with percentage elemental composition, mass spectra, infra-red spectra, ^{1}H and ^{13}C NMR spectra for at least four known simple organic compounds. **Relate** their structures to their percentage elemental composition, mass spectra, infra-red spectra, ^{1}H and ^{13}C NMR spectra, using the information provided. Calculate the empirical formulae using percentage of elemental composition and using mass spectra determine the molecular formulae. Use infra-red spectra to identify corresponding alkane, alkene, alcohol, ester, carboxylic acid, aldehyde or ketone. Using the NMR spectra work out the number and position of hydrogen and carbon atoms that correspond to the appropriate structural formulae. • You will be provided with percentage elemental composition, mass spectra, infra-red spectra and ^{1}H and ^{13}C NMR spectra for two unknown organic compounds (to include one functional group and one aromatic compound). **Analyse** the spectra of each compound to correctly identify their structure. In a logical way, analyse percentage elemental composition, mass spectra, infrared spectra, ^{1}H and ^{13}C NMR spectra. Present a full written analysis of the logic used to elucidate the structural formulae of the compounds to justify their identification and giving evidence of other possibilities that were rejected during the stages of the analysis. Section 2 - Chromatographic analysis • **Explain** the function of the components of a capillary GLC and an HPLC instrument that you have drawn using a block diagram on paper or on a computer (A photocopy from a book or a downloaded diagram is not acceptable). Research and **explain** how the techniques are used in two HPLC and two GLC specific example applications. • Using your own or given data from GC and HPLC chromatograms, **identify** organic components of a mixture from retention times and/or spiking results. You should also accurately use chromatograms or peak area data from either a GC or an HPLC chromatogram in order to **determine** the amount of an analyte present.. This could involve the production of a calibration graph for the analyte.
Checklist of evidence required	A portfolio that includes: • Evidence from qualitative and quantitative interpretations of different spectra to identify two unknown (one functional group and one aromatic)

	organic compounds. • An explanation of the principles of infra-red, mass, ^{1}H and ^{13}C spectroscopic techniques and how they are used to identify organic compounds. • A report of how you linked the structure of at least four known simple organic compounds to their spectra. • An interpretation of data from GLC and HPLC chromatograms to give the identity and amount of organic compounds. • An explanation of the operation of GLC and HPLC instrumentation and how the techniques are used in two GC and two HPLC applications.

Criteria covered by this task:	
Unit/Criteria reference	To achieve the criteria, you must show that you are able to:
D.D4	Analyse different spectra and percentage composition data to identify the structure of unknown organic compounds
D.M7	Determine the identity and amount of organic compounds using GC and HPLC chromatograms
D.M6	Relate different spectra and percentage composition data to the structure of known organic compounds
D.P9	Explain the operation of GC and HPLC instrumentation to separate and identify organic compounds
D.P8	Explain the principles and use of spectroscopic techniques to identify organic compounds
Sources of information to support you with this Assignment	All sources of information suggested are UK based. Centres are free to amend these sources to those available in the Country of delivery where more appropriate. www.edu.rsc.org - Introduction to spectroscopy, Infra-red spectroscopy, NMR spectroscopy, Spectroscopy in a suitcase, Spectroscopy videos; Chromatography, Chromatography Techniques www.STEM.org.uk - introduction to proton NMR www.tes.com – infrared spectroscopy www.chemguide.co.uk – gas-liquid chromatography, high performance liquid chromatography, the background to NMR Within the copyright laws learners could search YouTube for:–Chromatography, NMR spectroscopy

Notes to the Assessor and technician	The practical activities suggested for this assignment are required to be safety checked by the Centre before use. Pearson Education can take no responsibility for the safety of any practical activities. Before doing any practical activity, you should always carry out your own risk assessment and refer to the necessary regulations. In particular, any local rules issued by your employer must be obeyed, regardless of what is suggested here. Centre should use Health and Safety information provided by a reputable source. In the UK such an example organization is CLEAPSS http://science.cleapss.org.uk/